

Appl. No. 10/811,415
Response Dated Jan. 17, 2006
Reply to Office Action of October 18, 2005

REMARKS

Claim Rejection Under 35 U.S.C. 103

Claims 1, 3, 6, 13, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dai et al. (US Patent 6,232,706) in view of Yaniv et al. (US Patent 6,312,303).

In response to the rejection, Applicant respectfully traverses this rejection and submits that claims 1, 3, 6, 13, and 15 are allowable in their current form.

Claim 1, as originally filed, recites in part:

A method for making a carbon nanotube-based field emission device comprising steps of:

...

forming a cathode electrode on the top of the carbon nanotube array; and

removing the substrate so as to expose the carbon nanotube array.

First of all, Applicant submits with respect to the rejection of claims 1, 3, 6, 13, and 15 that the Examiner has failed to set forth a prima facie case for obviousness of the claimed invention, as required under 35 U.S.C. §103. Specifically, the Examiner admits that the primary reference, Dai et al. (U.S. Patent 6,232,706) "are silent regarding the limitation of forming a metallic cathode electrode on the top of the carbon nanotubes array." The Examiner then attempts to use Yaniv et al. (US Patent 6,312,303) as a secondary

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reference to overcome the shortfalls of Dai et al.

However, the Examiner has not provided appropriate weight to the teaching of Dai et al. and thus has misconstrued the reference. Dai et al. discloses that each of Figs. 1 and 5 illustrate field emission devices ("Description of the Figures" section). In each embodiment the carbon nanofiber bundles 28 are grown upon and then remain attached to a substrate 22 (Fig. 3, Steps A-C; and Fig. 4). No embodiments of a field emission device 20 are presented by Dai et al. that do not incorporate both the bundles 28 and the substrate 22. Thus, Dai et al., on the whole, teaches away from the removal of the substrate 22 in creating a field emission device 20. As set forth at MPEP §2143.01 and the related case cites, the prior art must be considered in its entirety, including disclosures which teach away from the claims.

The Examiner does contend that removal of nanotubes from the substrate, as set forth in Column 4, lines 58-64, serves as teaching by Dai et al. of a field emission device that does not retain the initial substrate 22 as part of the final device 20. Yet, a closer inspection of that quoted section reveals that Dai et al. does not disclose or suggest that the removed nanotubes were still to be used in a field emission device, i.e., a device not incorporating the original substrate 22 (Emphasis added.). In fact, the only information supplied by Dai et al. is that more nanotubes could grow at the locations from which the original nanotubes were excised. Moreover, there is no teaching or suggestion that upon removal from the substrate 22 whether such nanotubes would even remain in the form of bundles 28 or if they would become separated from one another. Accordingly, the shortfalls associated with Dai et al. extend beyond a lack of teaching of a step of "forming a metallic cathode electrode on the top of the

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carbon nanotubes array”, as contended by the Examiner. Specifically, Dai et al. further fails to teach or suggest a method of “making ... a field emission device” that involves the step of “removing the substrate so as to expose the carbon nanotube array”, as required by claim 1.

In discussing Yaniv et al., the Examiner expressly states that “forming a metallic cathode electrode on the top of the carbon nanotubes array (1102) in order to improve the efficiency of the emission device.” While Yaniv et al. admittedly discloses the formation of a “conductive layer ... used to produce the electric field for emission of electrons from the carbon nanotubes 1102 ...” (Column 3, lines 41-46), Yaniv et al. clearly does not disclose or suggest the step of removing such nanotubes 1102 from a base substrate after the conductive layer 1103 is formed thereon. Accordingly, Yaniv et al. is unable to overcome all the shortcomings of Dai et al. Therefore, Dai et al. in view of Yaniv et al. fails to teach or suggest each and every limitation set forth in claim 1.

Applicant submits, for reasons essentially provided above, that such subject matter, as set forth in claim 1, is neither taught, disclosed, nor suggested by Dai et al., Yaniv et al., or any of the other cited references, taken alone or in combination.

Similarly, claim 13 recites in part:

A method for making a carbon nanotube-based field emission device comprising steps of:

...

depositing a layer of metallic material on the top of the carbon nanotube array; and

removing the insulative substrate.

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Applicant submits that such subject matter as set forth in each of claims 1 and 13 is neither taught, disclosed, nor suggest by Dai et al., Yaniv et al., or any of the other cited references, alone or in combination.

Applicant submits that the arguments set forth above with respect to claim 1 are equally applicable with respect to the allowability of claim 13.

Furthermore, although Dai et al. does disclose removing the substrate 22, Applicant submits that the motivation to remove the substrate 22 is to illustrate that the substrate 22 is to remain capable of growing carbon nanotubes (col. 4, lines 58-63), and not for exposing the bottom of the carbon nanotube bundles 28, which had been connected with the substrate 22, to permit the connection of such bundles 28 to some other layer or substrate. Therefore, Dai et al. clearly does not teach or suggest each and every claimed element, as set forth in claims 1 or 13. As set forth above in the discussion of claim 1, Yaniv et al. is unable to overcome this shortcoming of Dai et al.

In summary, there is nothing in the cited references that teaches or suggests to one of ordinary skill in the art that they might or should provide the method for making a carbon nanotube-based field emission device, as set forth in either of independent claims 1 and 13.

Claims 3, 6, and 15 depend directly from claims 1 and 13 respectively, which are in condition for allowance for the reasons set forth above. Accordingly, Applicant submits that claims 3, 6, and 15 are now in condition for allowance, the allowance of which is hereby respectfully requested.

Claims 4, 5, and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dai et al. (US Patent 6,232,706) in view of Yaniv et al.

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(US Patent 6,312,303) and in further view of Hsu (US Publication 20020042241).

Claims 4, 5, and 7 depend directly or indirectly from claim 1, which is in condition for allowance for the reasons set forth above. Accordingly, Applicant submits that claims 4, 5, and 7 are now in condition for allowance, the allowance of which is hereby respectfully requested.

Claims 2, 8-9, 11, 12, 14, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dai et al. (US Patent 6,232,706) in view of Yaniv et al. (US Patent 6,312,303) and in further view of Mirkin et al. (US Publication 20030049381).

As regards independent claim 8, neither Dai et al. nor Yaniv et al. disclose or suggest that the removed nanotubes were still to be used in a field emission device, one not incorporating the original substrate 22 (Emphasis added.), as set forth in claim 8, for the reasons set forth above. Additionally, Mirkin et al., cited by the Examiner as a teaching of a variation in flatness of the surface of the substrate is less than 1 micron, is unable to overcome the shortcomings associated with the other two references. Specifically, all of the above references do not disclose or suggest that the substrate for growing carbon nanotubes requires a variation in flatness of less than 1 micron (Emphasis added.).

Additionally, Mirkin et al. is not able to overcome other shortcomings of Dai et al. and Yaniv et al., as set forth respect above to claims 1 and 13.

Applicant submits, for reasons essentially provided above, that such subject matter, as set forth in claim 8, is neither taught, disclosed, nor suggested by Dai et al., Yaniv et al., Mirkin et al., or any of the other cited

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references, taken alone or in combination. Applicant submits that claim 8 is now in condition for allowance, the allowance of which is hereby respectfully requested.

Claims 2, 9, 11, 12, 14, and 16 each depend from one of claims 1, 8, and 13, each of which is in condition for allowance for the reasons set forth above. Accordingly, Applicant submits that claims 2, 9, 11, 12, 14, and 16 are also now in condition for allowance, the allowance of which is hereby respectfully requested.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dai et al. (US Patent 6,232,706) in view of Yaniv et al. (US Patent 6,312,303) and in further view of Mirkin et al. (US Publication 20030049381) and in further view of Samalley et al. (US Patent 6,183,714).

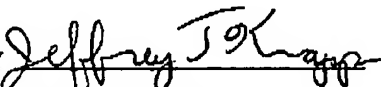
Claim 10 depends directly from claim 8, which is in condition for allowance for the reasons set forth above. Accordingly, Applicant submits that claim 10 is now in condition for allowance, the allowance of which is hereby respectfully requested.

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In view of the foregoing, the present application as defined in the pending claims is considered to be in a condition for allowance, and an action to such effect is earnestly solicited.

Respectfully submitted,

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